knowledge of the atmosphere up to 20 km. Beyond 25 or 30 km. we have little prospect of direct observations, but various luminous phenomena, especially meteors and auroras, offer excellent opportunities for making deductions. The body of observations of meteors, particularly as to velocities, heights of appearance and disappearance, lengths of paths, and luminosities, is sufficient to allow the computation of sizes of meteors, densities of the air traversed, and, with other aids, probable temperatures and compositions of the atmosphere to a height of 200 km. Most meteors seem to have a size of the order of 1 mm. in diameter. Yet at their speeds of from under 15 to over 100 km. per second they so compress the air in their paths that it is heated to a degree high enough (2,000–4,000 A) to volatize at least the surface material of the meteor and to render it highly luminous.

The density of the air required to produce this effect must be 10 to 100 or more times greater than that computed by assuming that the temperature above 20 km. is the same as at that height. At 100 km. meteors seem to indicate a density of 0.00000001 gm. per cc. [cf. 0.001293 gm./cc. at standard sea-level conditions]. This greater than assumed density must be largely owing to higher temperatures and, therefore, more expanded and elevated layers of air.

It seems probable that the temperatures observed in the stratosphere, about 220 A (163° F.) obtain up to a height of 50 km., while from 60 to 160 km. the temperatures are about 300 A (81° F.). Above 200 km. the temperature may again be 220 A. The warmth of the layer from, say, 60 to 160 km., is ascribed to an absorptive layer of ozone, formed, presumably, by the action of the ultra-violet light on such oxygen as is present in the upper portion of the atmosphere. The absorption of ultra-violet radiation here appears to be responsible for the fact that only one twenty-thousandth part of the ultra-violet (wave length 2,900 Ångströms), probably coming from the sun, reaches the earth's surface in clear weather.

The solar heat absorbed in the ozone layer is perhaps 5 per cent of the total reaching the outer atmosphere. There appears to be a marked change in temperature from winter to summer, with a corresponding higher air density, and therefore higher limits at which meteors disappear in summer than in winter. A similar seasonal change in the height of the aurora will be looked for. The presumption of a change in temperature between 50 and 60 km. is strengthened by the marked infrequency with which meteors cross from the warm into the cold layer without fading out and the occurrence of luminosity with meteors at apparently lower velocities in the lower part of the warm than in the upper part of the cold layer. Furthermore, the well-known occurrence of a zone of sound outside a zone of silence about a great explosion could be explained by the presence of a warm layer beginning at a height of about 60 km.

The meteor observations do not support an assumption of the predominance of hydrogen at the heights where meteors occur. As in the lower atmosphere, the air seems to be predominantly nitrogen up to 160 km. Above this some rather doubtful observations indicate the presence of a lighter gas, probably helium, if, as seems likely, hydrogen is negligible.—*C. F. B.*

EFFECT OF CLIMATIC CONDITIONS ON FRUIT TREES.[1]

By Prof. H. A. Phillips.

Author's summary.

(1) While many factors, such as available food, abundant water supply, pruning, spraying, and tillage, contribute to successful orcharding, there is none of more relative importance than climatic conditions.

(2) Epochs in fruit-bearing trees are retarded in their development by an increase in altitude. According to the data the average retardation is one day for every 101 feet.

(3) The average rate retardation in the blooming period of fruit-bearing trees is 4.6 days for every degree of increase in latitude. The greatest retardation is through the Atlantic States, and the least through the Pacific States.

(4) Epochs are earlier westward, and the lines of full-bloom dates and the ripening dates travel in a northeast direction.

(5) In the Atlantic and the Mississippi sections the rate of retardation is not constant. This is explained by conditions affecting the rest period. From the thirty-sixth parallel southward in the Mississippi Valley and the thirty-eighth parallel southward in the Atlantic section there is very little difference in the time of the blooming period.

(6) There is much greater uniformity in the epochs in fruit-bearing trees through the Pacific States, due primarily to the influence of the prevailing westerly winds from the Pacific Ocean.

(7) The ripening dates along any section travel faster than the blooming dates.

(8) The general average range of full-bloom dates at any given place is about three weeks.

(9) The number of days for the development of the ripened fruit is greater in the Pacific section than in the Atlantic and the Mississippi sections. Also the number is greater in the southern part of the Atlantic and the Mississippi sections than in the northern part.

(10) The peach, wherever grown, appears to be more uniform in its development than the other fruits.[2]

WEATHER AND CORN WILT.

Corn wilt, known as Stewart's disease, has been found in a large number of States, both in the South and the North. In the fields where found the number of diseased plants has been usually less than 20 per cent, but as high as 100 per cent infection has occasionally been found among the earlier varieties.

Dr. F. V. Rand, pathologist, and Miss Lillian C. Cash, scientific assistant, United States Department of Agriculture, have conducted field studies of this disease in Maryland during three seasons. A short account of results was published in the *Journal of Agricultural Research*, Vol. XXI, No. 4, May, 1921.

Varietal influence was found to be considerable, the earlier varieties being much more susceptible to the

[1] Author's thesis: Effect of climatic conditions on fruit trees in relation to the blooming and the ripening dates and the length of the growing period.

[2] The same data used by Doctor Phillips were partially summarized and presented in maps and tabular form in "Graphical summary of seasonal work on farm crops," by O. E. Baker, C. F. Brooks, and R. G. Hainsworth in Department of Agriculture Yearbook, 1917.